

## REMARKS

Claims 1-5 and 7-10 are pending.

Claim 1 has been amended to further define Applicant's invention. Support for the amendment can be found in claim 6 as originally filed. Claim 8 has been amended to address the rejection based on 35 U.S.C. § 112. Support for the amendment can be found in claim 7 as originally filed. No new matter has been added.

Claim 6 has been cancelled.

### Objections under 37 C.F.R. § 1.75(c)

Claim 6 stands objected to as allegedly "being of improper dependent form for failing to further limit the subject matter of the previous claim." Applicants respectfully disagree with the objection but have canceled claim 6 to expedite prosecution of the case.

### Rejection under 35 U.S.C. § 112

Claim 8 stands rejected under section 112 because the phrase "the regenerated copper" lacks sufficient antecedent basis. In response, Applicant's have amended the phrase to "the removed copper." Support for the amendment and sufficient antecedent basis can be found in claim 7. Applicants respectfully request that this rejection be reconsidered and withdrawn.

### Rejections under 35 U.S.C. 103(a)

1. Claims 1 and 4-10 stand rejected under 35 U.S.C § 103(a) as being unpatentable over Fronsman et al. (Fronsman), US 3,825,484 in view of Japanese patent 51-119632. The Office asserts that Fronsman

"discloses a method for regenerating etching solutions containing iron for use in etching...copper alloys, comprising feeding the etching solution to be regenerated from the etching system into the cell, comprising anode and cathode, means for removing the copper and means for collecting the copper, wherein the cell does not have a membrane, oxidizing the Fe(II) to Fe(III) at the anode and depositing copper at the cathode and recycling the solution to the etching system."

The Office further asserts that the Japanese patent teaches "the step of applying a potential to prevent the redissolving of copper." Applicants respectfully disagree with the rejection.

The Supreme Court in *Graham v. John Deere*, 383 U.S. 1, 17, 86 S.Ct. 684, 694 (1966) set out the factual inquiry which the various district courts and the Patent Office must follow in determining obviousness. The Supreme Court's mandate was as follows:

"[u]nder 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances."

### Scope and Content of the Prior Art

Fronsman discloses an apparatus comprised of: an unsealed casing; a plurality of rotating cathodes; a plurality of stationary anodes; a means for removing copper from the cathodes; and a means for collecting the copper in a bin. Figures 1, 2, and 6; Specification at column 1 lines 60-72 and column 5 lines 1-47; column 4 lines 18-19, 43-46; and column 5 lines 21-44.

The Japanese patent 51-119632 discloses a method for treating copper etching solution in an unsealed electrolytic cell containing a cathode and a plurality of anodes. Cuprous chloride is oxidized to cupric chloride at the anodes and metal copper is generated at the cathode. The cathode is separated from the anodes by a diaphragm, described as the cathode chamber. Copper accumulates at the bottom of the cathode chamber where a potential is applied to prevent dissolution of the copper. Abstract and Figures 1 and 2.

### Differences Between the Prior Art and the Claims at Issue

Amended claim 1 is directed to a method for regenerating etching solutions containing iron. The method comprises feeding the solution to be regenerated into a sealed electrolysis cell. The electrolysis cell contains one cathode, one anode, means for removing copper from the cathode, and means for collecting and applying a potential to the removed copper. The cell does not contain an ion exchange membrane or a diaphragm. Further, amended claim 1 requires the etching solution to contact the cathode first followed by the anode. Managing the flow of the etching solution in this manner enhances efficiency of the cell because Fe(III), generated at the anode, cannot circulate back to the cathode, where it can be reduced back to Fe(II).

The Fronsman apparatus is unsealed as indicated in Figure 2 where the dotted line, numbered as 27, represents liquid level. Specification at column 4 lines 43-46. The apparatus contains a plurality of cathodes and a plurality of anodes. The cathodes and anodes are positioned within the cell in such a manner that the etching solution contacts the cathodes and anodes at the same time until flowing out of the cell. See Figure 1. As a result, Fe(II) oxidized to Fe(III) at the anodes can be reduced back to Fe(II) at the cathodes before leaving the cell. This flow pattern, clearly, decreases cell efficiency. Finally, the Fronsman apparatus does not disclose application of a potential across the collected copper to prevent its dissolution.

The Japanese patent discloses a method for oxidizing cuprous chloride in an etching solution to cupric chloride, not Fe(II) to Fe(III). The method, as described in Figures 1 and 2, uses an unsealed cell that contains a cathode and a plurality of anodes. The anodes are separated from the cathode by a diaphragm and the flow pattern allows the etching solution to contact the cathode and anode at the same time.

In summary, Fronsman and JP 51-119632, combined, disclose an unsealed cell that contains a plurality of anodes and has a flow pattern that allows the solution to contact the cathode and anode at the same time. The claimed invention comprises a sealed electrolytic cell with one anode and a flow pattern that results in the etching solution contacting the cathode first then the anode.

#### Level of Ordinary Skill in the Pertinent Art

The Office asserts that "the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the disclosure of Fronsman in view of the teaching of the Japanese patent, because the patent teaches the use of a cathodic potential to prevent redissolving." Applicants disagree.

The claimed invention as a whole oxidizes Fe(II) to Fe(III) and reduces Cu(II) to Cu metal efficiently with one cathode and one anode. One skilled in the art, based on Fronsman and the Japanese patent, could not predict nor reasonably expect that an electrolytic cell with one cathode and one anode could efficiently regenerate an iron containing etching solution. Both Fronsman and the Japanese patent describe multiple anodes in an unsealed cell where the flow pattern allows the etching solution to contact cathodes and anodes at the same time. There is no

suggestion nor teaching within the cited documents, explicit or implicit, to combine the following elements disclosed in amended claim 1: a sealed electrolytic cell; a flow pattern where the etching solution contacts a cathode first followed by an anode; means for removing copper metal from the cathode; means for collecting the copper metal; applied potential across the copper metal; and no ion exchange membrane or diaphragm. There is no suggestion nor teaching in Fronsman and JP 51-119632 to reduce the number of anodes to one in a sealed cell where the solution contacts the cathode first then the anode.

The MPEP provides that:

"to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references (or references when combined) must teach or suggest all the claim limitations."

MPEP 2143 Basic Requirements of a *Prima Facie* Case of Obviousness.

Here, three elements are missing. Neither Fronsman nor the Japanese patent describe an electrolytic cell that is: (1) sealed; (2) has a flow pattern where the etching solution contacts the cathode first and then the anode; and (3) contains one anode. Therefore, Applicants respectfully submit that a *prima facie* case of obviousness does not exist, reconsideration and withdrawal of the 103(a) rejection is respectfully requested.

2. Claims 2 and 3 stand rejected under 35 U.S.C § 103(a) as being unpatentable over Fronsman in view of the Japanese patent, and further in view of Harms US 3,933,606. The Office asserts that:

"The combination of the Fronsman and the Japanese patents do not disclose the use of potentiometric measurement to control the current flow through the cell. The Harms patent is cited to teach the control of current based upon readings of concentration (see claims 10-13).

Therefore, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the disclosure of Fronsman in view of the teaching of the Harms patent, because the patent teaches the use of concentration measurements to control the current fed to an electrolytic cell."

Applicants respectfully disagree with the rejection.

As stated above, an obviousness analysis includes: (1) determining the scope and contents of the prior art; (2) ascertaining the differences between the prior art and the claims in issue; and (3) resolving the level of skill in the pertinent art. A discussion of Fronsman and the Japanese patent is found above. The analysis with respect to Harms follows.

#### Scope and Content of the Prior Art

Harms relates to the field of fluid purification, and in particular, to a process for electrolytically treating contaminated water. Specification at column 1 lines 5-8. The process consists of passing water vertically upward through a plurality of perforated cathodes and anodes to remove suspended and dissolved contaminants. Specification at column 2 lines 1-38; and Claim 1. One contaminant that can be removed by this process is iron. Specification at column 6 line 46. The Harms specification discloses that iron cations form hydroxides, i.e.  $[\text{Fe}(\text{H}_2\text{O})_x(\text{OH})_2]^{+++}$ , "which polymerize and initiate the formation of a floc." Specification at column 7 lines 8-18. Further, as the water passes through the column, the conductivity of the water is measured. This conductivity is used to regulate or change the electrical signal supplied to the plurality of anodes and cathodes. Specification at column 2 lines 40-65.

#### Differences Between the Prior Art and the Claims at Issue

The Harms invention removes metals such as iron and copper from the solution as their respective hydroxides. The claimed invention oxidizes iron from the +2 state to the +3 state and Fe(III) is not removed from the solution but is retained and reused in the copper etching process. With regard to copper, the claimed invention removes copper from the solution as the metal, not as the hydroxide. Further, the Harms process pumps contaminated water through a plurality of alternating cathodes and anodes. The claimed invention's flow pattern results in the etching solution contacting one cathode and then one anode before exiting the electrolytic cell.

In summary, Fronsman, JP 51-119632, and Harms combined disclose an electrolytic cell that contains a plurality of anodes and has a flow pattern that allows the solution to contact the cathode and anode at the same time or in a repeating alternate manner. The claimed invention comprises an electrolytic cell with one anode and a flow pattern that results in the etching solution contacting the cathode first then the anode before exiting the cell.

### Level of Ordinary Skill in the Pertinent Art

One skilled in the art, based on Fronsman, the Japanese patent, and Harms, could not predict nor reasonably expect that an electrolytic cell with one cathode and one anode could efficiently regenerate an iron containing etching solution. All three cited references disclose multiple anodes in an electrolytic cell where the flow pattern allows the solution to contact cathode(s) and anodes at the same time or in an alternating manner. The disclosed flow patterns and anode/cathode arrangement allows the oxidized Fe(III) to be reduced back to Fe(II), a less efficient approach. There is no suggestion nor teaching within the cited documents, explicit or implicit, to combine the following elements disclosed in amended claim 1: a sealed electrolytic cell; a flow pattern where the etching solution contacts a cathode first followed by an anode; means for removing copper metal from the cathode; means for collecting the copper metal; applied potential across the copper metal; and no ion exchange membrane or diaphragm.

Finally, as provided above, three conditions must be met to establish a case of obviousness: (1) there must be some suggestion or motivation to combine references found in the prior art; (2) there must be a reasonable expectation of success; and (3) the prior art references must teach or suggest all the claim limitations. Here, two elements are missing from the combined cited documents. All three references describe a process or apparatus that consists of a plurality of anodes where the flow of solution results in the contact of cathodes and anodes at the same time or in an alternating manner. Amended claim 1 discloses one anode and a flow pattern that results in the solution contacting one cathode and then one anode before exiting the electrolytic cell. Therefore, Applicants respectfully submit that a prima facie case of obviousness does not exist, reconsideration and withdrawal of the 103(a) rejection is respectfully requested.

In view of the above amendments and remarks, Applicants respectfully submit that the pending claims are allowable. Reconsideration of this application is respectfully requested and a favorable determination is earnestly solicited.

Applicants urge the Examiner to contact Applicants' undersigned representative at (312) 913-0001 if the Examiner believes that this would expedite prosecution of this application.

Respectfully submitted,

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